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MERCHANT SHIP NAVAL AUGMENTATION PROGRAM

Jodi E. Tryon, LCdr., USN

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The Merchant Ship Naval Augmentation Program (MSNAP) is a research and development program. It supports a procurement plan whereby merchant ships will be modified to allow rapid installation of modular or standardized underway replenishment (UNREP) equipment such as the Standard Tensioned Replenishment Alongside Method (STREAM) gear delivery system or fuel transfer station gear. MSNAP gear enables merchant ships to operate as naval auxiliary UNREP ships to conduct consolidation operations and limited direct replenishment of combatant ships.

This memorandum describes the MSNAP demonstrations that were performed in 1981 and 1985 and discusses the status of MSNAP funding, planned ship modifications, and ship manning issues.

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MERCHANT SHIP NAVAL AUGMENTATION PROGRAM

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ABSTRACT

The Merchant Ship Naval Augmentation Program (MSNAP) is a research and development program. It supports a procurement plan whereby merchant ships will be modified to allow rapid installation of modular or standardized underway replenishment (UNREP) equipment such as the Standard Tensioned Replenishment Alongside Method (STREAM) gear delivery system or fuel transfer station gear. MSNAP gear enables merchant ships to operate as naval auxiliary UNREP ships to conduct consolidation operations and limited direct replenishment of combatant ships.

This memorandum describes the MSNAP demonstrations that were performed in 1981 and 1985 and discusses the status of MSNAP funding, planned ship modifications, and ship manning issues.

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INTRODUCTION

This memorandum is part of a study by the Center for Naval Analyses (CNA) of the Mobile Logistics Support Force (MLSF). An earlier CNA memorandum appraised the sealift assets available to support the fleet and the material and administrative arrangements for management of those assets [1]. CNA also examined the process for establishing requirements to reactivate ships for use in military contingencies and the issues affecting the use of those ships—especially in the MLSF role [2].

Present and anticipated inventories of underway replenishment (UNREP) ships may be insufficient to support the fleet. Many of the ships in the Ready Reserve Force (RRF) are merchant ships not originally designed to perform UNREP. If these ships (in addition to any Navy MLSF ships that were added to the RRF) are to be used for underway replenishment, they must be modified. The Merchant Ship Naval Augmentation Program (MSNAP) has been developed to help increase UNREP capability if needed by preparing the merchant ships to fulfill UNREP roles.

MSNAP is a research and development program supporting a procurement plan whereby merchant ships will be modified to allow rapid installation of modular or standardized UNREP equipment such as the Standard Tensioned Replenishment Alongside Method (STREAM) gear delivery system or fuel transfer station gear. Ship modifications include the installation of sliding padeyes and fuel hoses and connections, which are described below. MSNAP gear enables the ships to operate as naval auxiliary UNREP ships to conduct consolidation operations and limited direct replenishment of combatant ships. As first envisioned, only the connections and adaptors were to be put on reserve fleet ships, with the actual replenishment gear installed just before the ships' sailing with the MLSF. Current planning now calls for the installation of sliding padeyes and hoses as they become available. The change in plans is an effort to avoid congestion in the shipyards in the event of a crisis; it also allows the ships to be used to augment regular UNREP assets during peacetime. The change in plans is possible due to the recent growth in the size of the RRF [3].

This memorandum describes the MSNAP demonstrations that were performed in 1981 and 1985 and discusses the status of MSNAP funding, planned ship modifications, and ship manning issues.

MSNAP EQUIPMENT AND OPERATIONS

Sliding Padeye

The sliding padeye is the necessary connection that permits dry-cargo MSNAP ships to conduct replenishment consolidation at sea. Reference [4] describes the sliding padeye and its operation, and figure 1, from [4], illustrates the padeye.

The sliding padeye raises and lowers the padeye to which a highline is attached. A sliding padeye is a rectangular frame of steel beams about 4 feet wide and about 19 to 20 feet high. The inside faces of the beams act as guides for a strong steel block that slides up and down the frame on a long threaded fixture, the jackscrew. The jackscrew is driven by an electric motor. The face of the block has a ring, or padeye, affixed to it. The sliding padeye is installed on the main deck of a merchant ship and acts as the attachment point for the replenishment rig sent over by a Navy MLSF ship. It is lowered to a point near the deck so the crew can connect the replenishment rig. The padeye is raised high enough for the traveling cargo block and hooks of the MLSF ship to clear the bulwarks or rails. It is then lowered to hook up the load to be transported, and raised to clear the rails. A sliding padeye at a receiving station on the MLSF ship or combat vessel permits good load control throughout the transfer cycle and allows the receiving station to return heavy loads to the delivery station.

The Navy UNREP 88 Study was used in procurement planning. Thirteen ships were selected to be outfitted with sliding padeyes. With four padeyes per ship, 52 sliding padeye systems are required [5].

STREAM Gear

The MSNAP program has developed modular POL (petroleum, oil, and lubricants) and dry-cargo STREAM rigs for installation on merchant ships as specified. These rigs meet the same performance requirements as a standard Navy system.

Information about STREAM equipment can be found in [4]. Figure 2, from [4], illustrates a typical sliding padeye receiving station and a STREAM rig.

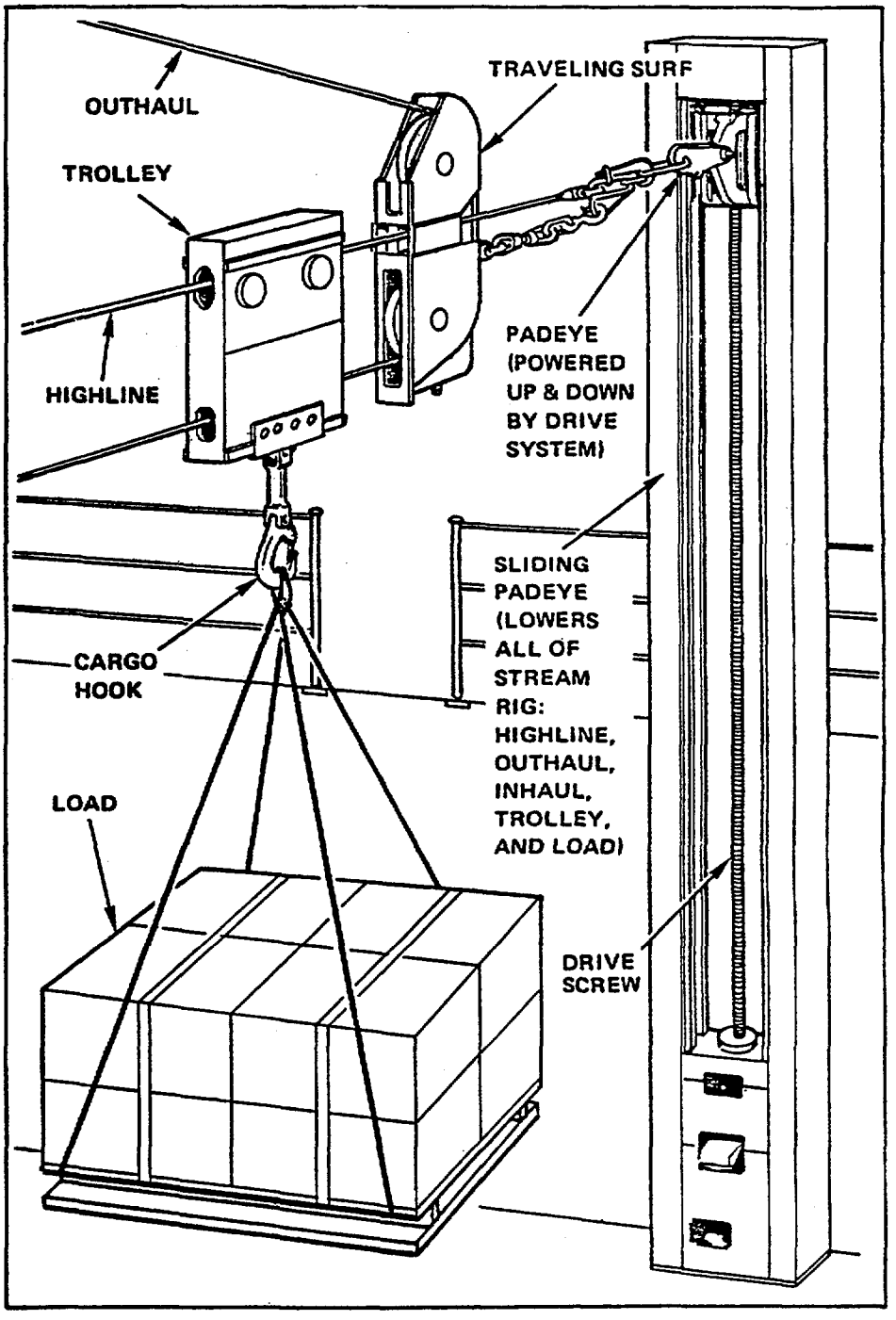

FIG. 1: SLIDING-PADEYE RECEIVING STATION – RECEIVING THE LOAD

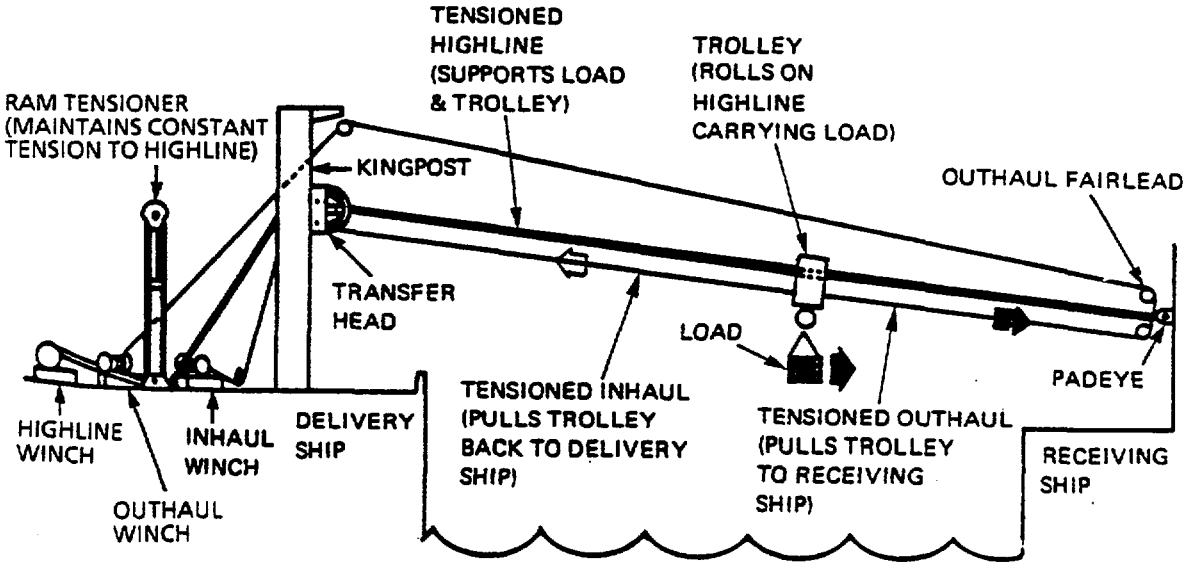

FIG. 2: MISSILE / CARGO STREAM RIG (Tensioned Wires)

MSNAP equipment will prepare break bulk cargo ships and merchant tankers to transfer cargo at sea to battle group UNREP ships using the UNREP ship STREAM rigs. Figure 3 is a sketch of the STREAM modular cargo delivery station. It can be installed quickly on a merchant tanker or break bulk cargo ship to provide limited capability for transfer at sea if no UNREP ships are available.

In cargo transfers using STREAM gear, the cargo is suspended from a trolley that rides on a tensioned wire highline from the delivery station on the MSNAP ship to a receiving station on an MLSF or combat ship. The cargo is supported during the transfer by the tension in the highline, and the tension remains the same regardless of ship motion.

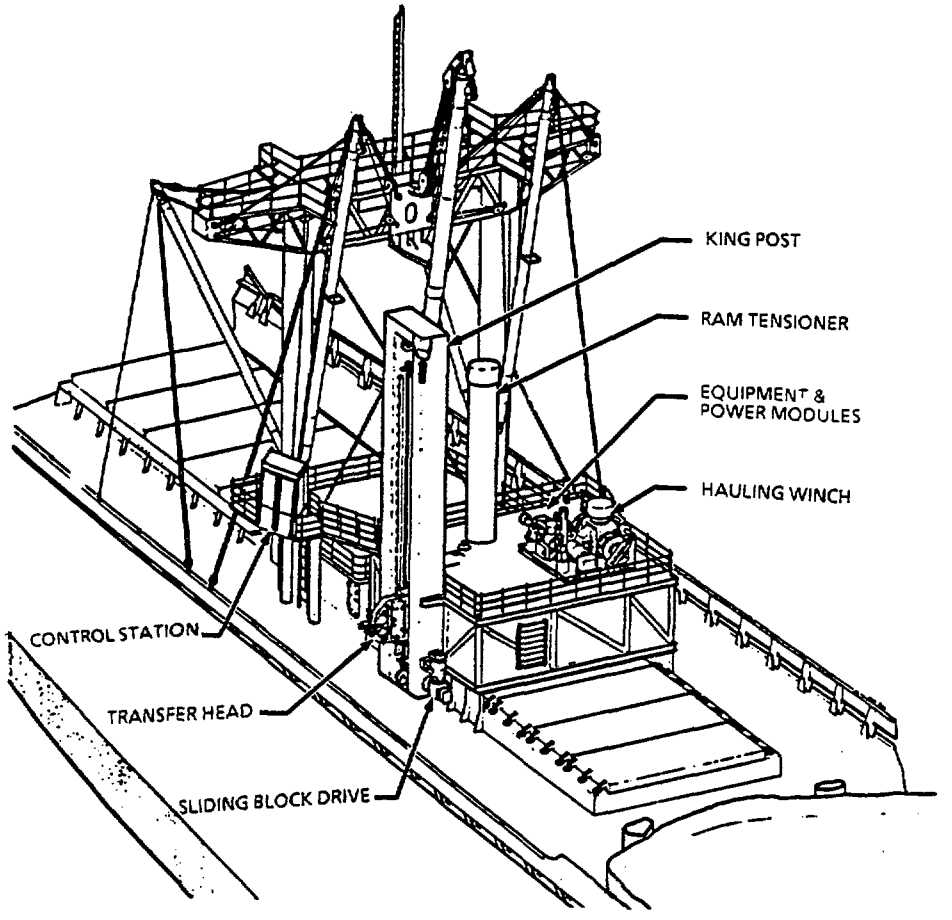

FIG. 3: MODULAR CARGO DELIVERY STATION

Major equipment for a STREAM transfer station includes a kingpost, a sliding block, and a STREAM transfer head. The sliding block is driven by chains or hydraulic pistons up and down on a track inside the kingpost. The highline and inhaul are reeved through sheaves inside the sliding block and transfer head. The movement of the sliding block controls the vertical travel of the transfer head, highline, trolley, and suspended load.

When STREAM is being rigged, the sliding block is lowered close to the deck. The block is then raised to the top of the kingpost to lift a load from the deck and transfer it. The block is lowered again to bring the empty cargo hook close to the deck to pick up the next load. When the STREAM gear is operated to a sliding padeye receiving station, only a cargo hook is required on the trolley.

Cargo Flatrack

A cargo flatrack is a 20- or 40-foot intermodal container measuring 8 by 8-1/2. It has no sides, ends, or top. Palletized cargo is secured to the flatrack with wire nets to D-rings in the flatrack deck, and the unit is loaded aboard the ship as if it were a regular container. Flatracks may be used to create "tween-decks" in container ship cells to fill the gaps between cells and for lighting [6].

Modular Elevator

The modular elevator is in two parts. "Multiple guide rail modules are assembled in an empty cell to form an elevator shaft, personnel ladder and shaftway for utilities. The top-most module contains the elevator machinery, control system, and platform [6]." The elevator can be used to transport equipment, forklifts, and ordnance. It is open on two sides to facilitate access to the platform.

MSNAP SHIP PERSONNEL

UNREP operations using MSNAP ships will be labor-intensive, requiring crew augmentations. MSNAP manning will use civilian seamen primarily – either civil service marines through the MSC or merchant seamen from private industry through local maritime union hiring halls.

Because specific elements of the Military Sealift Command routinely perform fleet consolidation operations, its civil service seamen have some training or experience in UNREP operations. Civilian seamen generally lack the qualifications and experience in cargo handling and radio communications necessary to become integrated with a Naval task force, and several factors may inhibit building a pool of MSNAP-experienced civilian seamen. By Executive order, the Navy is required to follow union rules in hiring civilian seamen. There are currently about twice as many union members as there are maritime positions, so union rules usually give jobs to seamen on a basis of seniority, with frequent crew changes. Continuity in experience may be difficult with the crew turnovers and attrition of senior merchant seamen as they approach retirement. The U.S. Government or the maritime unions may have to conduct courses and hands-on training for younger seamen to ensure trained personnel will be available.

The U.S. maritime industry is shrinking, and the number of civilian seamen may decrease proportionally. At the same time, MSNAP equipment is scheduled for installation on a growing number of RRF ships. A time may come when local union hiring halls may not have enough merchant seamen available to man needed MSNAP ships in support of fleet operations. Key shipboard personnel are particularly vulnerable to shortages. For example, during the Vietnam War era when merchant seamen were plentiful, there were temporary shortages in key merchant seamen personnel (e.g., engineering officer). Unions have attempted to forestall this happening again by preplanning personnel assignments for key positions on RRF ships. If an RRF ship is reactivated, the named personnel are notified to report to the ship. More than one person may be identified for a key position on a particular ship, and one individual may be identified for manning several ships. This ensures that a reactivated ship has personnel and alternates available for all key positions. Unlicensed personnel are not generally pre-identified, however, and local union hall shortages may require obtaining crew members from distant union hiring halls or having mixed-union crews. It is uncertain how union representatives would respond in this case [7].

By Executive order, the seamen's pay will be comparable to the wages they receive from private industry; however, shipboard lifestyles on board MSNAP ships of necessity will be inferior to shipboard conditions aboard ships in private industry. Modern merchant ships have accommodations for a crew of about 30 people. MSNAP requires over 20 additional ship personnel for most MSNAP functions [8]. Augmentation personnel may be lodged in temporary hotel support facilities on or below the decks. It may be difficult for maritime union members to accept living conditions below the level obtained from private industry.

SYSTEM DEMONSTRATIONS

The USNS *Northern Light* (TAK-284) was selected as the first MSNAP ship for a test demonstration conducted in June 1981. It is one of eight SS *Mormacpride*-class break bulk cargo ships. The ships of this class were built in the early 1960s by Moore-McCormack for commercial use. The Military Sealift Command (MSC) currently uses the *Northern Light* for Arctic resupply missions. One of the reasons that the *Northern Light* was chosen for the demonstration is that it is similar to many U.S. flag break bulk cargo ships (e.g., USNS *Southern Cross* (TAK-285) and USNS *Vega* (TAK-286)).

Ship characteristics of the *Northern Light* include [9]:

- Displacement: about 16,400 tons full load
- Tonnage: 9,361 tons, gross; 12,537 tons, dead weight
- Length: 487 feet overall
- Beam: 68 feet
- Draft: 31-5/12 feet
- Propulsion: steam turbines; 12,100 SHP; 1 shaft
- Boilers: 2
- Manning: 50 civilians
- Helicopters: no facilities
- Missiles: none
- Guns: none.

The *Northern Light* has a sustained speed of 18 knots; many similar ships are capable of sustained speeds of 20 or 21 knots [10].

Modifications to the ship were made in May 1981 and included [10]:

- Various ordnance dunnage systems for testing
- Electrical forklifts and facilities for use below decks
- Diesel forklifts and facilities for use on the weather decks
- Ordnance loads (gun ammunition, bombs, and missiles) and heavy-lift aircraft engines
- Personnel housing modules

- Preventer system to restrain booms during cargo breakout while underway

- Sliding padeyes forward and aft for transfer of ordnance to the UNREP ship using the UNREP ship STREAM gear

- Six-man personnel chair for the transfer of cargo-handling personnel between the UNREP ship and the shuttle cargo ship.

The demonstration of the *Northern Light*'s MLSF dry-cargo resupply capabilities was conducted with the USS *Butte* (AE-27). Performance goals for MSNAP shuttle ships established by the MSNAP operation request are [10]: (1) sustained speed of 20 knots and adapted to carry up to 4,000 tons of palletized cargo (Note: [10] states that the *Northern Light*'s sustained speed is 18 knots), (2) sustained transfer rate of 20 to 30 loads per hour per rig to the USS *Butte,* (3) three or four transfer-at-sea stations, and (4) outfitting with a helicopter pickup zone. The actual demonstration included the following [10]:

- A test of the STREAM transfer system

- Transfer of heavy loads (aircraft engines) on the aft sliding padeye

- Transfer of simulated dry stores pallets on the aft sliding padeye

- Transfer of 81 loads on the forward sliding padeye and 74 loads on the aft sliding padeye while simultaneously breaking out from three holds

- Transfer of dummy bombs, powder, ammunition, missiles, and dry stores at night in sea state four conditions. No helicopter demonstration was attempted [8].

During this demonstration, the *Northern Light*'s cargo booms removed the test cargo directly from the ship's holds, and forklifts moved the goods to the replenishment stations. The cargo was then transferred to the USS *Butte* using the *Butte*'s transfer rigs. The N*orthern Light* accomplished the cargo transfer at about 70 percent of the rate expected from an ammunition ship (AE) in the same mode of operation (single-side, connected replenishment). This test demonstrated the feasibility of cargo transfers from MSNAP ships to MLSF ships that can supply the transfer rigs, but did not demonstrate an MSNAP ship's capability to transfer cargo to a combat ship, where the rigs would have to be supplied by the merchant ship. Figure 4 summarizes this

Concept: Joint CINCLANTFLT/NAVSEA effort to demonstrate feasibility of transferring dry cargo from a merchant ship to a Navy MLSF ship at sea.

- 27 May through 10 June 1981
- Navy ship: USS *Butte* (AE-27)
- Merchant ship: USNS *Northern Light* (TAK-284)

Characteristics of test platform (*Northern Light*)

- C-3 break bulk ship
  - 15,404 tons displacement fully loaded
  - Maximum speed 19 knots
- Modified for trial during overhaul in March and April 1981
  - Two sliding padeyes
  - Four five-man berthing modules
  - Two sanitation modules (showers, toilets, sinks, waste treatment)
  - Ship's passenger lounge converted to 18-man bunkroom.

Demonstration:

- Cargo
  - 600 tons inert ordnance and representative provisions in simulated fleet issue loads loaded on *Northern Light*
  - Seven complete UNREPs conducted; *Butte* provided transfer rigs
  - 400 pallets/loads transferred, including 8,000-pound aircraft engine (transfer rates per rig comparable to fleet performance)
  - Cargo handled on *Northern Light* by ship's booms (yard and stay) and fork trucks
- Manpower
  - NAVCHAPGRU provided 1 officer and 27 enlisted as surrogate industrial workers (can support all single-station transfers)
  - For two-station transfers, additional 29 men transferred to *Northern Light* from *Butte*
  - Tests revealed augmentation requirement of 18 to 31 men
  - Habitability for augmentation personnel was satisfactory.

Conclusions: According to the trial report, a fully equipped and augmented general-purpose C-3/C-4 break bulk ship can deliver ordnance, provisions, and stores to Navy MLSF ships by connected replenishment (no VERTREP capability). The transfer rate is about 70 percent that of an AE in the same mode of operation (single-side, connected replenishment).

FIG. 4: USNS *NORTHERN LIGHT* DEMONSTRATION

first demonstration of the MSNAP system [8]. The test demonstrated that a fully equipped and augmented general-purpose break bulk ship can deliver ordnance, provisions, and stores to MLSF ships. Funding for MSNAP hardware procurement was initiated shortly after this demonstration.

Another MSNAP demonstration was conducted in May 1985 in the Mediterranean Sea. It involved the USNS *Southern Cross* (TAK 285), manned with a civilian union crew in the first dry-cargo consolidation directly to a fleet combat store ship (AFS). In this case, the USNS *Southern Cross* was outfitted with two sliding padeyes, dunnage system, material handling equipment (MHE), berthing/sanitation modules, and other components to support its MLSF augmentation capability. The AFS supplied the transfer rigs. The demonstration involved the transfer of provisions (both dry and frozen), consumables, repair parts, and fleet freight in an operational environment [3]. Overall, this demonstration was a success and pointed out areas in which additional training and planning may be needed [11].

After the demonstration, the *Southern Cross* proceeded to Augusta Bay to onload retrograde ordnance material (bomb fins), but the crew's union representative threatened a job action. Claiming it was not in the negotiated contract between the ship's operator and the union to load retrograde "ordnance," the crew threatened not to load the material. The master intervened and negotiated a settlement in this case, but the event gave concrete evidence that the threat of such job actions could affect future operations unless contracts are written carefully and provision is made to bring civilian crews under military rules and control in wartime operations.

FUNDING

MSNAP began as a research and development program in the late 1970s. As first envisioned, it could be capable of augmenting many phases of the Navy's support and replenishment system, including UNREP, tenders, hospital ships, troop ships, and towing and salvage. To date, funding limitations have confined much of the MSNAP development to the MLSF environment. Two notable exceptions are the development of sea sheds and flatracks, which have enhanced the use of container ships for cargo lifts.

Current MSNAP objectives with respect to the MLSF include developing UNREP delivery capabilities of petroleum, oil, and lubricants (POL) and dry cargo (including ammunition) and expanding current POL consolidating

capabilities of selected merchant ships [3]. The first significant funding measure for MSNAP hardware procurement occurred in fiscal year 1982, following the successful USNS *Northern Light*/USS *Butte* cargo transfer demonstration in June 1981. MSNAP funding for pursuing MLSF research and development objectives has continued since FY 1982.

The 1984 POM allocated FY 1984 funds for MSNAP development efforts and hardware production, but not for hardware installation. The 1985 POM allocated FY 1985 funds for the acquisition of additional sealift enhancement features and did include hardware installation. Eighteen sliding padeyes were purchased in FY 1984 with the funds allocated in FY 1982. Because installation was not funded in FY 1984, the sliding padeyes were warehoused to await installation in FY 1985. The sliding padeyes purchased in earlier fiscal years will be installed on selected ships over several years, beginning in FY 1985.

FY 1985 was the first year in which funding was available for POL delivery systems. Procurement of dry-cargo delivery systems is scheduled to begin in FY 1986, and the systems are scheduled for installation in FY 1986 on selected MSC long-term charter tankers and other selected ships.

SHIP MODIFICATIONS

MSC long-term charter tankers and RRF ships will be selected to undergo the first ship modifications. These ships will be selected because they are government-owned or under government control. As funding becomes available, specific ships will be selected, based on configuration, to provide the best overall fleet for the MSNAP program [3]. In general, C-4 class cargo/ammunition ships and 225,000-barrel ("handy size") *Sealift*-class tankers are expected to be selected.

C-4 class cargo/ammunition ships have varying characteristics depending upon their subclassifications. For example, C-4-S-57a class RRF merchant ships include the *American Challenger*, the *American Champion*, and the *American Chieftain* and have the following general characteristics [12]:

- Gross tonnage: 11,105 tons
- Length: 561 feet overall

- Breadth: 75 feet
- Draft: 32 feet
- Deadweight: 13,566 tons
- Speed: 21 knots
- Fuel: 2,538-ton bunker capacity
- Range: 12,00 miles at sustained speed with normal fuel capacity
- Dry cargo: 643,000 cubic feet
- Reefer capacity: 44,000 cubic feet net
- Liquid cargo capacity: 8,000 barrels
- Capacity heaviest boom: 70 tons.

The SS *Cape Ann* and the SS *Cape Alava* are examples of C-4-S-58a class RRF ships with the following characteristics [12]:

- Gross tonnage: 11,309 tons
- Length: 572 feet overall
- Breadth: 75 feet
- Draft: 31 feet
- Deadweight: 12,728 tons
- Speed: 20 knots
- Fuel: 2,890-ton bunker capacity
- Range: 17,000 miles at sustained sped with normal fuel capacity
- Dry cargo: 630,000 cubic feet
- Reefer capacity: 290,000 cubic feet

- Liquid cargo capacity: 82,000 barrels
- Capacity heaviest boom: 60 tons.

The tonnage and deadweight tonnage are greater for these two classes of ships than for the demonstration ship, the USNS *Northern Light.*

Nine *Sealift*-class tankers were built between 1974 and 1975 by Todd Shipyards, San Pedro, California, and Bath Iron Works, Maine. These ships were built specifically for the MSC to replace the T2-type tankers from World War II. They have the following characteristics [12]:

- Length: 587 feet overall
- Breadth: 84 feet
- Draft: 35 feet
- Deadweight: 27,200 tons
- Speed: 16 knots
- Fuel: 3,444 tons
- Range: 2,000 miles
- Liquid cargo capacity: 225,000 barrels.

Ship modifications will be performed during the ships' scheduled annual or biennial shipyard repair periods or RRF upgrades [3]. The planned modifications include equipping merchant ships by FY 1991 as follows [13]:

- Nineteen merchant ships (tankers) will be configured with astern refueling platforms for rapid installation of the NATO Astern Reelable Refueling Key. Eleven ships (including *Falcon Princess, Falcon Duchess, Falcon Lady, Falcon Countess, Overseas Alice, Overseas Valdez, Overseas Vivian,* and *American Explorer*) have been modified previously. In early 1986, eight additional ships will be earmarked to receive the astern refueling modifications.

- Six other selected MSC/RRF tankers will each receive two alongside refueling systems for direct delivery of POL to combatant ships. Current plans call for the last three new T-5 tankers now being built to be outfitted with two alongside transfer stations each. Three additional tankers, unidentified as yet, will also receive two stations each.

- Under the MSNAP program, 12 ships will receive dry-cargo delivery systems and associated hold access and cargo-handling equipment (including sliding padeyes, restraint systems, and hatch-cover lifters, for example) and compartmentization. Whether a delivery system is designated as an ammunition transfer system or as a stores transfer system will depend upon the ship on which the equipment is installed. Seven ships selected with an eye-to-ship configuration will be designated as ammunition delivery ships, and five other ships will be designated as stores delivery ships. So far, only USNS *Southern Cross* received the necessary sliding padeyes and associated equipment to prepare the ship for the May 1985 Mediterranean Logistics exercise. The remaining 11 ships will be selected in 1986.

- Five merchant ships will receive dry-cargo delivery systems for transfer of stores to combat ships.

The *Sealift*-class tankers have three refueling-at-sea stations (two alongside and one astern). Each alongside station can receive up to two 6-inch hoses from a replenishment ship and is capable of handling up to 8,000 barrels of fuel per hour. The astern refueling rig has one 6-inch hose for bunkering small combatants [14].

Reference [15] lists several problems that must be overcome before container ships can be used to augment UNREP ships. First, dry cargo can be transferred at sea only in units weighing less than 6,000 pounds. The containers must be opened and unstuffed to permit transfers. Second, because the containers would be stacked six to nine high, temporary weapons-handling elevators may be required to strike up ammunition. Last, a means must be devised for fork trucks to unload pallets from containers stacked more than one high above the weather deck.

The Container Ship Strike-up System (CSUS) is a modular elevator system that is being developed for use within container ship holds. The cargo

holds of container ships are divided into modules fairly easily, because the holds are large open spaces without "tween-decks." For MSNAP, flatracks or sea sheds can be used to create "tween-decks" in the container ship's cells. Break bulk or palletized cargo is carried on these decks. Vacant areas are left for use by forklifts. The cargo is struck up or down by the CSUS. A sliding padeye erected on an appropriate foundation and restraint system is used in the cargo transfer, as explained in [6]:

> The sliding padeye provides a variable height rigid point to which is connected the transfer rigging from the MLSF ship to be replenished. Palletized cargo is taken to the sliding padeye station from the elevator station by forklift, attached to the rigging hook by slings and then transferred by highline using the receiving ship's rigging and winch system.

One container stack will be filled with the CSUS modular elevator, as described above. Other modular units include dunnage and cargo-handling equipment for handling cargo below decks and for "striking" up the cargo to the main deck UNREP delivery station [13].

Mission support subsystems for MSNAP include hotel support for embarked UNREP personnel, communications, electrical power, lighting, ventilation, maintenance, and fire fighting. Some of the components for these systems will be modularized or containerized.

NAVSEA will procure the MSNAP equipment under competitive contracts. Ships will be outfitted with alongside refueling, UNREP consolidation, and UNREP delivery systems as the equipment is received, and astern refueling platforms will be installed on MSC/RRF tankers. Rigs funded through the NATO infrastructure will be warehoused for installation at the time of a contingency, according to NATO instructions. Container Ship Strike-up Systems will be stored also [13].

ADVANTAGE OF MSNAP

MSNAP is a research and development program that leads to the procurement of Sealift Enhancement Features that provide the capability to enhance merchant ships for greater military utility to perform as augmentations to Naval auxiliaries. The MSNAP ships are intended to

augment MLSF assets. Their primary advantage is the speed and low cost with which the ships can be activated and placed in service when the need arises. The construction of new, dedicated MLSF ships would take longer and cost more.

In FY 1984, for example, the Navy purchased 19 break bulk merchant ships for $31 million. Underway dry-cargo delivery capability modifications will also cost $5 million per ship. For tankers, alongside refueling modifications will cost $5 million per ship. Once modifications are made to the break bulk ships and tankers, the ships can be maintained in the RRF for $700,000 per year per ship. In the event of a contingency, reactivation costs for RRF ships would be $1.6 million per ship. The installation of consolidation equipment, alongside refueling equipment, or underway dry-cargo delivery equipment would cost $1.2 million, $1.3 million, or $1.8 million, respectively, for the appropriate ship type. (All figures are in FY 1987 dollars). Thus, the Navy can obtain limited MLSF UNREP capability augmentation at a relatively inexpensive cost per ship through the MSNAP process [3]. The degree of augmentation and the possibility of substituting MSNAP ships for Navy MLSF ships have not been fully studied.

SUMMARY

The 1981 USNS *Northern Light* and 1985 USNS *Southern Cross* cargo transfer demonstrations using MSNAP equipment showed that the MSNAP program could help decrease the shortfall in fleet UNREP capability in the near term. The program has promise as a means of modifying RRF ships so that they can supplement underway refueling and cargo transportation assets.

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19. ABSTRACT *(Continue on reverse if necessary and identify by block number)*

The Merchant Ship Naval Augmentation Program (MSNAP) is a research and development program. It supports a procurement plan whereby merchant ships will be modified to allow rapid installation of modular or standardized underway replenishment (UNREP) equipment such as the Standard Tensioned Replenishment Alongside Method (STREAM) gear delivery system or fuel transfer station gear. MSNAP gear enables merchant ships to operate as naval auxiliary UNREP ships to conduct consolidation operations and limited direct replenishment of combatant ships.

This memorandum describes the MSNAP demonstrations that were performed in 1981 and 1985 and discusses the status of MSNAP funding, planned ship modifications, and ship manning issues.

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